how these genes may interact with other genes to predispose people to cancer.

Morham is looking further at the inflammatory responses of the COX-2 knock-out mice, and is also studying ulceration in these mice. Both researchers hope this work will produce better NSAIDs in the future, as well as benefit patients who take these drugs.

Who Pays to Clean Up Livestock Waste?

Widespread coverage by both the popular and scientific press in the last year pointed out the seriousness of environmental problems associated with livestock waste, particularly waste lagoons. Feces and urine from confinement buildings are typically washed into earthen lagoons, from which they can leak into groundwater at a rate of 500 gallons per acre each day, according to the Washington, D.C.-based Sustainable Agriculture Coalition, a public interest environmental group. Lagoons can also spill directly into surface waters. In the wake of last year's spills that dumped millions of gallons of animal waste into North Carolina and Iowa waterways, Congress recently adopted a bill in the 1996 Farm Act intended to address the livestock waste problem.

Known as the Environmental Quality Incentive Program (EQIP), the bill provides technical assistance to livestock operators such as incentive payments to keep farmers from spraying liquid waste from lagoons along stream banks, and cost-share assistance for building livestock waste facilities. Farmers would be eligible to receive as much as $10,000 a year with a cap of $50,000.

In a March letter to Alice Rivlin, director of the Office of Management and Budget, EPA Administrator Carol Browner lauded EQIP and recommended that President Clinton sign the 1996 Farm Bill. EQIP also enjoys overwhelming support in Congress and is supported by environmental groups, with one caveat. Environmentalists favored the Senate version of EQIP, which had set a limit on the size of farms that are eligible to receive cost-share funds; livestock operations would have to be smaller than those defined as point sources of water pollution in the Clean Water Act (i.e., 1,000 beef cattle, 2,500 hogs, or 100,000 poultry). In contrast, while the version of EQIP that passed prohibits "large confined livestock operations" from receiving these cost-share funds, it stops short of defining "large" and leaves that decision to the discretion of the Secretary of Agriculture.

Some livestock operations can have more than 100,000 beef cattle, 10,000 hogs, and 400,000 chickens. The question being asked is whether operations this large should be eligible for federal cost-sharing funds to build animal waste management facilities. The answer depends on who you talk to. "We support LEAP [the Livestock Environmental Assistance Program, which was the House version of EQIP and set no size limits]," says National Pork Producers Council spokeswoman Deborah Atwood. "This is an environmental bill, not a structure bill. The numbers are irrelevant." LEAP [would] give USDA Secretary Dan Glickman the freedom to protect the most impaired watersheds from the effects of livestock waste, she says. (EQIP also leaves the size of operations eligible for funds to the discretion of the USDA secretary).

Some environmentalist groups disagree. "We think it is a structure issue," says Lonnie Kemp, policy director of the Canton-based Minnesota Project, a nonprofit organization devoted to rural and environmental issues. "Big factory farms get loans and investors and should be able to pay for waste management facilities." However, Kemp does support EQIP for operations smaller than the Clean Water Act limits, saying that financial incentives are an excellent way of encouraging farmers to minimize their impact on the environment. There are also some dissenters in Congress who, like Kemp, think EQIP should set eligibility size limits. "We should target the money to family farmers," says Mark Rokala, spokesman for Representative David Minge (D-Minnesota). "It can cost $30,000 to $50,000 to get feedlots to prevent [environmental] impact, which is significant cost for a guy with 1,000 head of cattle."

A more fundamental question about EQIP is whether waste lagoons are safe for the environment. Again, the answer depends on who you talk to. Waste lagoons are adequate when managed properly but many operators overfill them, making them more likely to spill over, says Deanne Morse, livestock waste management specialist at the University of California at Davis. Others say that waste lagoons are not safe even when managed properly, and that the real issue in livestock waste is large versus small operations. "There is as yet no workable technology for safely dealing with concentrated livestock waste from large operations," says Ferd Hoefner, the Sustainable Agriculture coalition's Washington representative. The coalition favors small family farms because they don't generate huge concentrations of animal waste and therefore can avoid the problem altogether, he says.

In response to concerns about the trend towards ever-increasing concentration in the livestock industry, the USDA appointed an advisory committee in February. The 21-member committee is expected to report on a variety of issues, including the effects of large livestock operations on the environment, by early June.

Rather than help farmers build waste lagoons, the federal government should develop and encourage alternative methods of managing livestock waste, says Paul Sobocinski, a farmer in Wabasso, Minnesota, who is also a staff member of the Land Stewardship Project, based in Marine, Minnesota. Existing alternative methods, which are more feasible for small livestock farms and are widely used in Europe, include dry bedding, which entails keeping the animals on straw and then composting the waste-laden straw.

"I don't need EQIP," says Dwight Ault of Austin, Minnesota, who uses the manure from his 700 hogs to fertilize his crops. "It will benefit the people who are the real polluters and is a short-term fix at best. In the long run it will do more damage than good because it will continue the push for largeness. Bigger is not necessarily better."

Pamlico-Tar River Foundation

Cleanup costs. New legislation provides funds for cleanup of livestock waste such as the spills that caused fish kills in Iowa and North Carolina rivers last year.

Lead and Delinquency

Part of society's recent increase in violence

may be due to lead poisoning. According to a study by Herbert Needleman of the University of Pittsburgh School of Medicine and colleagues published in February in the *Journal of the American Medical Association*, boys with higher bone-lead levels are more likely to be aggressive and delinquent.

"This is probably the most critical study that has been done on lead in the last five years," says Janet Phoenix, manager of public health programs at the National Lead Information Center of the National Safety Council, an international public interest organization. "The social implications are enormous."

Lead has been linked with behavioral problems since the early 1940s, when pediatrician R.K. Byers noted that some children he had treated for acute lead poisoning subsequently developed violent, aggressive behavioral difficulties such as attacking teachers with knives or scissors. Needleman's study, supported in part by the NIEHS, is the first to link asymptomatic levels of lead with aggressive behavior and delinquency.

Needleman and his colleagues studied 301 boys from primary schools in Pittsburgh. The researchers measured bone-lead levels by K X-ray fluorescence when the boys were about 12 years old. Based on the relative lead content of their tibias, the boys were divided into high- and low-lead groups. Bone-lead levels reflect lifetime exposure to lead because, like calcium, lead is stored in bones. The boys in the high-lead group had normal levels of lead in their blood by the time of the study, showing that their lead exposure had occurred in the past.

The researchers evaluated the boys' behavior at 7 and 11 years of age based on reports from three sources: the boys themselves, their parents, and their teachers. These data were from widely respected tests of antisocial behavior that had been administered by the Pittsburgh Youth Study, a longitudinal study of the developmental course of delinquency. At 11 years, the boys were given a self-reported delinquency interview, which comprises 35 questions such as how many times in the past six months a subject has "been drunk in a public place" or "attacked someone with a weapon." The parents and teachers filled out the child behavior checklist, which contains 113 symptoms of childhood behavioral disorders such as cruelty or bullying, shoplifting, setting fires, and apparent lack of guilt after misbehaving.

When the high-lead boys were 7 years old, neither they nor their parents reported significant behavioral problems, and their teachers reported only borderline tendencies toward symptoms such as social problems, delinquency, and aggressive behavior. By the time these boys were 11, however, they reported significant increases in antisocial acts, and their parents and teachers reported significant increases in symptoms such as delinquent and aggressive behavior. The researchers corrected for confounding factors such as the mothers' intelligence, the presence of the father, and socioeconomic status.

Many U.S. children have toxic bone-lead levels and—provided that their results are found to extend to the population at large—Needleman and his colleagues conclude that lead makes a substantial contribution to delinquent behavior. Other researchers hail the Needleman study as the first to rigorously demonstrate a link between lead and antisocial behavior. The study was well-designed and its implications are likely to be valid, according to Terrie Moffitt of the Department of Psychology at the University of Wisconsin at Madison. Self-reporting is trustworthy when the period reported on is less than a year, the interviews are private and face-to-face, and confidentiality is guaranteed, she says, and the Needleman study met these conditions. Furthermore, Needleman's conclusions are strengthened by the fact that reports from three sources—the boys, their parents, and their teachers—all linked lead with antisocial behavior.

Lead is a neurotoxin and human studies indicate that its neurological effects are likely to be irreversible. However, delinquency is also associated with factors such as weak parent-child attachment, lax parental supervision, and school failure. Addressing these issues can mitigate the effects of lead. "These kids need help. They need support from teachers and parents," says Phoenix. "No one knew they were lead-poisoned." The good news is that environmental lead exposure can be avoided. "Lead-related delinquency is the easiest to prevent," says Needleman. "We should be able to wipe this disease out by removing old lead-based paint."

Closing Chernobyl

Almost 10 years after the explosion and full-scale meltdown of a graphite core at the Chernobyl nuclear power plant in Ukraine, officials finally agreed to close the plant.

The governments of Ukraine, the Group of Seven (G-7) industrialized nations, and the Commission of the European Communities signed a memorandum of understanding on 20 December 1995 that outlines a comprehensive program for the closure of the Chernobyl nuclear power plant by the year 2000. The program's provisions include a focus on nuclear safety; the development of a financially sound electric power market with market-based pricing to encourage energy efficiency and conservation; and a social impact plan to address the effects of the closure of the plant on its employees and their families. Representatives of Ukraine, the G-7, and international financial institutions plan to meet annually to monitor the implementation of the program.

The memorandum allocates $2.3 billion in aid, including $349 million for nuclear safety and decommissioning activities and $1.9 billion for new energy investments. The funding will come from grants by G-7 countries and loans from international financial institutions, although the financing has not yet been worked out.

Financial details and the fact that the agreement is not legally binding have caused environmental groups to remain skeptical about the agreement. "If the West does not provide what Ukraine feels is sufficient capital, it's quite possible that Chernobyl might not be shut down," said Miriam Bowling, a research associate for the Natural Resource Defense Council's nuclear program. In addition, Bowling said, Ukraine faces political pressure from the Russian government, which prefers that Chernobyl stays open.

Environmental groups are also disappointed that the agreement includes the exchange of the closure of Chernobyl for the completion of two more nuclear reactors in Ukraine. However, as Bowling said, "It is a very important agreement, and it's great to see the words 'Chernobyl' and 'closure' on the same piece of paper."